AUTOMATIC EYEWEAR CLEANER

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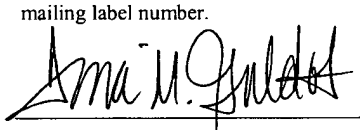

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Signature Date: January 21, 2004

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PRIORITY CLAIM

[0001] This application claims priority to the following U.S. Provisional Application No. 60/490,671, filed July 29, 2003 entitled "Automatic Eyewear Cleaner" (Attorney Docket No. SHPR-01404US0).

FIELD OF THE INVENTION

[0002] The present invention is directed to a system and method for cleaning eyewear.

BACKGROUND OF THE INVENTION

[0003] Whether they are for vision correction, vision protection or simply used as a fashion accessory, eyewear has long been a popular, if not indispensable, personal accessory. There are specialty eyewear which includes a wide range of eyeglasses and sunglasses that are designed for a specific purpose, such as computer use, driving, work, hobbies, eye protection and more. A huge variety of frames are available for prescription eyeglasses or sunglasses. Not only are there many different shapes and colors in eyeglass frames, but advances in technology have also brought a variety of new materials, for both the frames and the lens, which makes eyeglasses more durable, lightweight and comfortable. Eyeglass frames are now created from high-tech materials such as titanium and memory metals, while the lens are now thinner and lighter than ever before, even for high prescriptions. Lens coatings, including scratch-resistant coatings, ultraviolet treatments, anti-reflective coatings and mirror coatings, are commonly added to the lens to enhance their performance and appearance.

[0004] These high-tech frames and coated lens are expensive and are worth protecting. Unfortunately, the lens (even scratch-*resistant* coatings are not scratch-*proof*) can easily be damaged by casual cleanings by the wearer, leaving the lens with a unsightly scratched surface

that can hinder vision. As any eyewear user knows, eyewear can require cleaning with just a short time of wear. Because of the eyewear's close contact to the wearer, body oils, sweat, grime and dead skin cells gets trapped in the lens and frame and accumulate in little time. Dust, dirt and fingerprints on the lens add to this unwanted mess. Further, the metal finish of frames can corrode and become discolored from prolonged exposure to sweat, which is acidic in nature.

[0005] Wiping the eyewear with tissue paper or the corner of a shirt is a common practice for many eyeglass wearers. However, ordinary tissue paper and many types of cloths are highly abrasive because of their coarse fibers. Wiping the lens with these often lead to irreparable damage to the coating. Small, hard particles such as sand may also be deposited on the lens, and a simple wiping may be akin to polishing the lens with sandpaper.

[0006] Non-abrasive Micro-fiber Towels, with each strand of fiber being made of hundreds of micro-fibers (on the scale of 90,000 micro-fibers per sq. inch) have been gaining popularity in eyeglass care. These micro-fibers act to attract and hold dirt and grime, and can retain up to seven times its weight. The cloth used in micro-fiber towels is made of a matrix of polyester and polyamide weaved in such a way as to create a "clinginess" that picks up dirt. However, these towels are unable to reach tiny nooks and crannies of the eyeglass frame, and do not counteract the acidic corrosion of sweat. Further, because the cloths trap and hold grime, they get dirty very quickly and lose their effectiveness without frequent laundering.

[0007] Ultrasonic cleaners, such as the one taught in U.S. patent 4,114,194, have long been known in the field of professional jewelers and optometrists. The ability of a liquid when ultrasonically agitated to penetrate small spaces and, by cavitation, to remove foreign matter from solid objects has led to the wide use of ultrasonic cleaners in laboratories and industry. However, it is discovered that the use of ultrasonics tends to break down and remove the coating on the lens.

[0008] U.S. patent 5,988,910 teaches an eyeglass cleaning apparatus with a pair of lens engaging rollers made of soft web material mounted on a handle. A lens is passed between the rollers and the rollers are rotated to clean the lens simultaneous on both sides. The handle includes a pump for spraying cleaning solution on the lens prior to operation. This device cleans only one lens at a time, and requires constant movement by the user to cover all corners of a lens. Further, it is not designed specifically with cleaning the frame in mind.

SUMMARY OF THE INVENTION

[0009] An automatic, motorized eyewear cleaner is provided in accordance with an embodiment of the invention. The cleaner can clean practically any pair of eyeglasses by agitating them in a specially formulated cleaning solution, and then automatically drying them. The entire process from start to finish should take only about one minute.

[0010] It is, therefore, an object of this invention to provide an automatic device that can effectively and safely clean all manner of eyewear, regardless of whether the frame is plastic or metal, whether the lens are glass or plastic, or whether the lenses are coated or not. The device should be able to clean most shapes and sizes of frames and lens.

[0011] It is a related object of this invention to provide an automatic device that is small and compact, yet can receive and clean virtually all available eyewear.

[0012] It is a related object of this invention to provide a specially formulated solution for use in conjunction with the automatic device that is safe to materials and coatings used in eyewear that would dissolve dirt and grime on the eyewear and leave a chemical coat that fills in micro-scratches on the lens.

[0013] A further object is to have this chemical coat be anti-static to act as a repellent to dust particles.

[0014] A related object is to have the solution make the eyewear feel cool and refreshing to the wearer when they are put on after cleaning.

[0015] Another related object is for the solution to counteract the effects of corrosion caused by sweat.

[0016] It is another object of this invention to provide an automatic device that can effectively clean eyewear in the specially formulated solution and then substantially dry the eyewear, in sixty seconds or less.

[0017] It is a further object of the invention to provide an automatic device that is easy to operate and to maintain.

[0018] A related object of the invention to provide a device that is economical to operate, even with frequent use.

[0019] Another object of the invention is to provide a pleasing display of lights while the eyeglass is being cleaned.

[0020] The above and related objects are addressed by embodiments of the instant invention. In the following discussion, the terms eyeglasses, eyewear, glasses will have the same meaning, and refer to a common configuration comprising a frame, lens, nose rests, hinges, and ear pieces.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Fig. 1 shows a perspective view of an embodiment of an exterior of an automatic eyewear cleaner according to the invention.

[0022] Fig. 2 shows a perspective view of an embodiment of the invention, from a different angle, with a lid open and showing the removable tank underneath, with a pair of eyewear attached.

[0023] Figs. 3a and 3b show side views of a removable holding clip of an embodiment of the invention in open and closed positions respectively.

[0024] Fig. 4 shows a perspective view of the cleaner of an embodiment of the invention, with a solution tank removed.

[0025] Fig. 5 shows a cut-away perspective view of the cleaner of an embodiment of the invention from the back of the unit.

[0026] Fig. 6 shows a perspective isolation view of the mechanical parts of an embodiment of the invention.

[0027] Fig. 7 shows a cross-section view of an embodiment of the invention taken through line 7 - 7 in Fig. 1.

[0028] Fig. 8 is a perspective view of a cover for a solution tank of an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] An automatic eyeglass cleaner is provided in accordance with an embodiment of the invention. A specially formulated cleaning and conditioning solution is also provided for use with the automatic cleaner. A tank in the automatic cleaner is filled with the cleaning and conditioning solution; the eyewear is folded up and clipped to the bottom of the open lid of the cleaner, then the lid is closed to lower the eyewear into the solution. The cleaning cycle starts with the push of a button and the eyewear is agitated in the solution. The cleaning cycle stops automatically after a pre-set time, the lid pops up and any excess solution is shaken off the eyewear by the cleaner leaving a thin film on the lenses. A microfiber cloth is used to polish the lenses a quick final touch-up that helps fill in microscopic scratches. The whole process from start to finish should take only about one minute.

[0030] In Fig. 1, the exterior of an automatic eyewear cleaner ("cleaner") **10** is shown. In the illustrated embodiment, the cleaner **10** has a generally oval configuration. However, any configuration, which is pleasing in appearance, would be suitable. The cleaner has a lid **11** which pivotally opens upwards. The lid **11** covers the removable solution tank 13 into which the cleaning and conditioning solution is filled. In the embodiment shown, the tank fits in the general profile of the cleaner when installed. The tank is made to be removable from the cleaner for easy cleaning and disposal of spent cleaning solution. The housing of the cleaner **14** houses the electronics and motor, and has operating controls **15**. The controls shown, in the form of buttons **15a** and **15b**, opens the lid, and turns the cleaner on and off.

[0031] Fig. 2 shows the cleaner, from a different angle, with its lid **11** open and showing the removable tank **13** underneath. The tank slides out in the direction of arrow **21**. A small storage compartment **13a** can be made integral with the tank. An exemplary pair of eyeglasses **23** is shown in this diagram. A removable holder clip **24** for clipping the eyeglasses **23** is removeably attached to a receptacle **25** on an agitator arm **26**. The lid, shown here in its open configuration, should become (and remain) fully open at an angle sufficient for easy attachment and detachment of the clip and eyeglasses, with the tank filled and attached to the cleaner. The lid should remain open even with the full weight of the clip and eyeglasses attached to it, until the user presses down on the lid to close it. During the drying cycle, the lid opens, and raises the

glasses above the solution, until the user is ready to retrieve them. The lid opening and closing mechanism and the agitator arm is described further below.

[0032] Fill lines on the tank show a recommended minimum fill level and maximum fill level the solution should be filled to. A minimum level **28a** is set so that the solution will cover the entire eyeglasses when the lid is closed to lower the eyeglasses into the solution tank. The maximum fill level **28b** shows the maximum amount of solution that should be filled, in order to avoid spillage and splattering when the device is in operation and when the filled solution tank is removed for disposal of spent solution. A cover **81** (see Fig. 8) can also be used to seal the tank so the solution would not spill during transportation to and from a sink.

[0033] In Fig. 3a, a removable holding clip is shown in its closed configuration. The clip is ordinarily held shut by a spring **30**, and opens when pressure is applied to the handles **31a**, **31b**. When in the open position shown in Fig. **3b**, the clip can receive a pair of eyeglasses by positioning the clip over the nose bridge of a folded pair of eyeglasses. When pressure is removed, the clips close and hold the eyeglasses through retention means, such as rows of rubber teeth shown as **32a** and **32b**. The clip has a finger grip area **34** on the lower handle **31a** to facilitate easy loading and unloading of the clip into the cleaner without applying pressure to both handles, which would open the clip and release the glasses.

[0034] In a preferred embodiment of the invention, a magnet and metal combination is used to attach the clip (and the glasses held by the clip) to the receptacle on the agitator arm to allow for easy placement of the eyeglasses into the cleaner. A magnet or metal piece **33a** is made integral with an attachment part **33** on the clip, with a corresponding magnet or metal piece on a receptacle integral with the agitator arm. The clip will be magnetically drawn to the receptacle when in proximity to it, and the shape of the receptacle, which matches the attachment means on the clip, will ensure a secure fit. The magnet should be of sufficient strength to hold the clip loaded with eyeglasses throughout the cleaning and drying cycles, until the user removes the clip by simply pulling on it to disengage the magnet.

[0035] Fig. 4 shows a front view of the cleaner, with the solution tank removed and the cleaner lid not shown. Slots **41** slidably receive matching parts on the tank to ensure the tank is properly seated when loaded into the cleaner. The clip **24** is shown magnetically secured to the

receptacle **25**. The receptacle is integral with the agitator arm **26**, which extends into the cleaner housing **14** and forms a motor housing **27** for the motor **28** (described in detail below).

[0036] Fig. 5 shows a cut-away view of the cleaner housing from the back. The arm is aligned but not connected to the cleaner lid, with both being pivotally mounted along the same axis, **51**. The arm is designed to be separate from the lid so that when the lid is closed and the agitator arm is vibrated to agitate the eyeglasses in solution, the vibrations passing directly to the lid is minimized. The cleaner, thus, remains relatively stable on a flat surface as it is operated, because the vibrations from the agitation is kept internal to the cleaner.

[0037] Refer now to Fig. 6, which shows in isolation the mechanical parts of the cleaner, and Fig. 7, which shows a cross-section of the unit. Direction arrow **60** in both diagrams designate the front of the unit. The cleaner lid **11** is pivotally mounted at **62** on two damper torsional springs **63**, with the torsional springs secured with screws **64** onto the cleaner housing along axis **51** (see Fig. 6). The torsional springs exert tension to hold the lid in its open position. A part of the lid aft of the axis **51** extends inside the housing and forms a curved surface **11b**, which slopes downwards. The lid pivots around axis **51** as the lid is raised and lowered, and the curved surface moves in opposite relationship with the front of the lid. When the front of the lid is pushed down to close the lid, the curved surface pivot upwards and its end clicks onto a spring-loaded catch **70** and the lid is held closed (see Fig. 7). A raised rubber divot **61a** on the agitator arm, mounted forward of axis **51**, pushes down on the arm as the lid is closed and lowers the clip and the eyeglasses (not shown) into the solution tank. Button **15a**, which is depressed to open the lid, is integral with a push-rod **15** which extends downwards to come in contact with the catch. Depressing button **15a** pushes down on the rod, which would release the catch and allow curved surface **11c** to pivot downwards (from the tension exerted by the damper torsional springs **62**), thus raising the front of the lid. As the lid opens, it exerts pressure on raised rubber divot **61b** on the agitator arm positioned aft of the axis **51**, and raises the agitator arm to lift the eyewear out of the solution. In order to eliminate splatter as the eyewear is lifted, the damper torsional springs can be immersed in thick viscosity lubrication so that when the lid opens, it does so gradually.

[0038] As mentioned above, the agitator arm **26** extends into the cleaner housing **14** and is integral with a motor housing **27**, which holds the motor **28**. The motor housing and motor is

positioned aft of axis **51**. Refer to Fig. 5, when the agitator arm pivots around axis **51** as it is raised and lowered, the motor, being held by motor housing **27**, moves in opposite relationship to the front receptacle end of the arm. Refer to Fig. 7, the motor, held by the motor housing, remains integral with the agitator arm at all times, whether the agitator arm is raised or lowered.

[0039] In a preferred embodiment, the motor is powered by common DC batteries **71** which are inserted into the cleaner housing **14** through a door on the bottom. Referring back to Fig. 5, the motor rotates a shaft **54** which extends out of the sides of the motor, and onto which weights **55** are eccentrically mounted on each side. When the motor is turned on, strong, rhythmic vibrations are produced by the weights rotating off-center at high speed. The vibrations are directly transferred through the motor housing and onto the agitator arm, including the front receptacle. When the clip and eyeglasses are loaded onto the receptacle, they are vibrated as well. In a preferred embodiment, the motor should operate at about 1300 rpm, which is well below ultrasonic range, but still sufficient to produce strong agitation when the eyeglasses are in the cleaning solution, and sufficient to substantially shake dry the eyeglasses when they are raised from the solution. In a preferred embodiment of the invention, during the cleaning and drying cycles just described, the motor continues to operate uninterrupted at the same speed, with the difference being whether the front of the agitator arm is lowered or raised.

[0040] Once the lid is closed to lower the eyeglasses into the solution tank, the user depresses button **15a** to begin the automatic cleaning procedure. Referring back to Fig. 6, button **15a** depresses an electrical contact **67** to activate electronic timing circuitry **67**, turning on the motor. In an alternative embodiment, a mechanical or electro-mechanical timer can also be used. During the cleaning cycle, the motor operates for a preset amount of time and agitates the glasses in the solution. In a preferred embodiment, the cleaning cycles lasts about 40 - 50 seconds, which is sufficient time for the cleaning and condition solution to substantially dissolve and/or remove the dirt and grime from the frame and lens. At the expiration of this amount of time, the timing circuit begins the drying cycle and triggers an electromagnet **81** located in the housing, which attracts a metal piece **70a** integral with the releasable catch **70**. This pulls the catch backwards towards the electromagnet and releases the curved end **11b** of the lid, and the front of the lid is raised due to the tension exerted by the torsion springs. As discussed previously, the agitator arm (and the clip with eyeglasses attached to it) is raised out of the solution by the opening lid. The lid pivots around axis **51** until the front of the lid is stopped by edge **14a**, with the lid remaining

in its fully open configuration and the glasses held above the solution tank. The agitator arm continues to vibrate in this raised position, and the wet eyeglass is shaken substantially dry. Solution dripping from the eyeglasses is collected by the solution tank and can be re-used in future cleanings. In a preferred embodiment, the drying cycle lasts about 10 - 20 seconds, after which the timing circuit turns the motor off. Note that from the beginning of the cleaning cycle to the end of the drying cycle, the motor remains running uninterrupted.

[0041] In another embodiment of the invention, the electronic timing circuitry can also control the timing of LCD or LED lights **45** (see Fig. 4) positioned in the housing behind the solution tank and shine through the solution to create a pleasing lightshow. In this embodiment, the cleaner should be made of a transparent or translucent material for the light to shine through.

[0042] In a preferred embodiment, the novel cleaning and conditioning solution for use with the automatic eyeglass cleaner described above is comprised of deionized water, Berol 226, Triethanolamine 99, Hydroxymethylglycinate, Isopropyl Alcohol, Sorbitan Mono-oleate, acid blue 9 and Polydimethylsiloxane Emulsion. See Table 1 for the percentage by weight of each ingredient in a preferred embodiment.

TABLE I

INGREDIENT		PERCENT W/W	
Deionized Water		61.4	
Berol 226 (Akzo Nobel)		7.5	
Triethanolamine 99		10.5	
Hydroxymethylglycinate		3	
Isopropyl Alcohol		2.5	
Sorbitan Mono-oleate		5	
1% Acid Blue 9		0.1	
Polydimethylsiloxane Emulsion		10	

[0043] Berol SA is a blend of a nonionic and cationic surfactant optimized for use in water based degreasing cleaners. It is efficient for cleaning organic soils, such as grease and oil. Triethanolamine 99% is formed from the reaction of ethylene oxide and ammonia. It is miscible with water and alcohol and makes the solution alkaline, and improved grease removal and the

compatibility of the ingredients. A biocide, the aqueous solution of Sodium Hydroxymethylglycinate is derived from Glycine - a naturally occurring amino acid. It has broad pectrum antimicrobial activity and is effective against bacteria and fungi. Isopropyl Alcohol, also known as IPA, 2-propanol and isopropanol, is a colorless clear liquid with a pleasant odor. It is a good dehydrating agent and disinfectant. Sorbitan Mono-oleate is a light amber-color surfactant that is used as an nonionic lipophilic surface active agent. It is an emulsion stabilizer. The aqueous emulsion of polydimethylsiloxane is an anti-fogging agent and gives the eyewear a slick feel. It is a relatively inert, and is easy to dilute and disperse and is effective over a wide range of temperature and pH conditions. Acid Blue 9, also known as Brilliant Blue FCF, C.I. Acid Blue 9, diammonium salt, C.I. Acid Blue 9, and disodium salt, is a widely used food dye. It comes in a reddish-violet powder or granules with metallic luster.

[0044] The solution is manufactured by adding the above ingredients in the following order: deionized water, Berol 226, Triethanolamine 99, Hydroxymethylglycinate, Isopropyl Alcohol, Sorbitan Mono-oleate. The mixture is mixed until all the ingredients are dissolved and uniform. Next, 1% Acid Blue 9 is added to the solution and mixed. Polydimethylsiloxane emulsion is then added while the solution continues to be mixed, and the solution should be mixed for at least another fifteen (15) minutes to obtain the final solution in concentrate form having a pH of 9.2-10.2 and a specific gravity of 1.018-1.024 (gm/ml). The concentrate is to be diluted approximately 1:32 with ordinary tap water to obtain a cleaning solution for use in the cleaner.

[0045] The cleaning solution has the properties of being able to emulsify and dissolve body oils, dirt and grime deposited on the frame and lens. Further, the solution will form a thin film on surfaces it comes into contact with, especially the lens of the eyeglasses. This film can fill in micro-cracks and scratches on the surface of the lens and coating, and helps in restoring the surface of the lens.

[0046] After the drying cycle is complete, the frame and lens of the glasses should be substantially dry, with the thin film of silicone deposited on the lens. The user reaches into the open lid, and grabs the clip with his fingers. A simple pull will disengage the magnet holding the clip to the receptacle on the agitator arm, and the loaded clip is removed from the cleaner. The handles of the clip are depressed to release the eyeglasses. Finally, a micro-fiber cloth is used to

briefly polish and dry the lens, a quick final touch-up that helps the silicon fill in microscopic scratches. The sparkling-clean glasses are now ready to wear.

[0047] It will be appreciated that the instant specification, drawings and claims set forth by way of illustration and not limitation, and that various modification and changes may be made without departing from the spirit and scope of the present invention. Additional aspects, objects and advantages of the invention can be obtained through a review of the appendant claims and figures. It is to be understood that other embodiments can be fabricated and come within the spirit and scope of the claims and the invention.